

PRELIMINARY DATA SUMMARY

December 1992

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Measurements and Analysis work units at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility (FRF) in Duck, North Carolina. The FRF staff collected and analyzed these data. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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PART I: INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Figure 1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height of 7.6 m above the National Geodetic Vertical Datum (NGVD) of the year 1929. In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Clifford F. Baron at (919) 261-3511.

Part II presents the meteorological data; Parts III through VI present oceanographic data; Part VII presents nearshore profiles and bathymetry; and Part VIII, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used, their operational status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depths at the wave gages and current meters vary and may be determined from information contained in Figure 7. Other installation information is contained in Table 1.

Times given in the report, unless otherwise specified, are referenced to eastern standard time (EST).

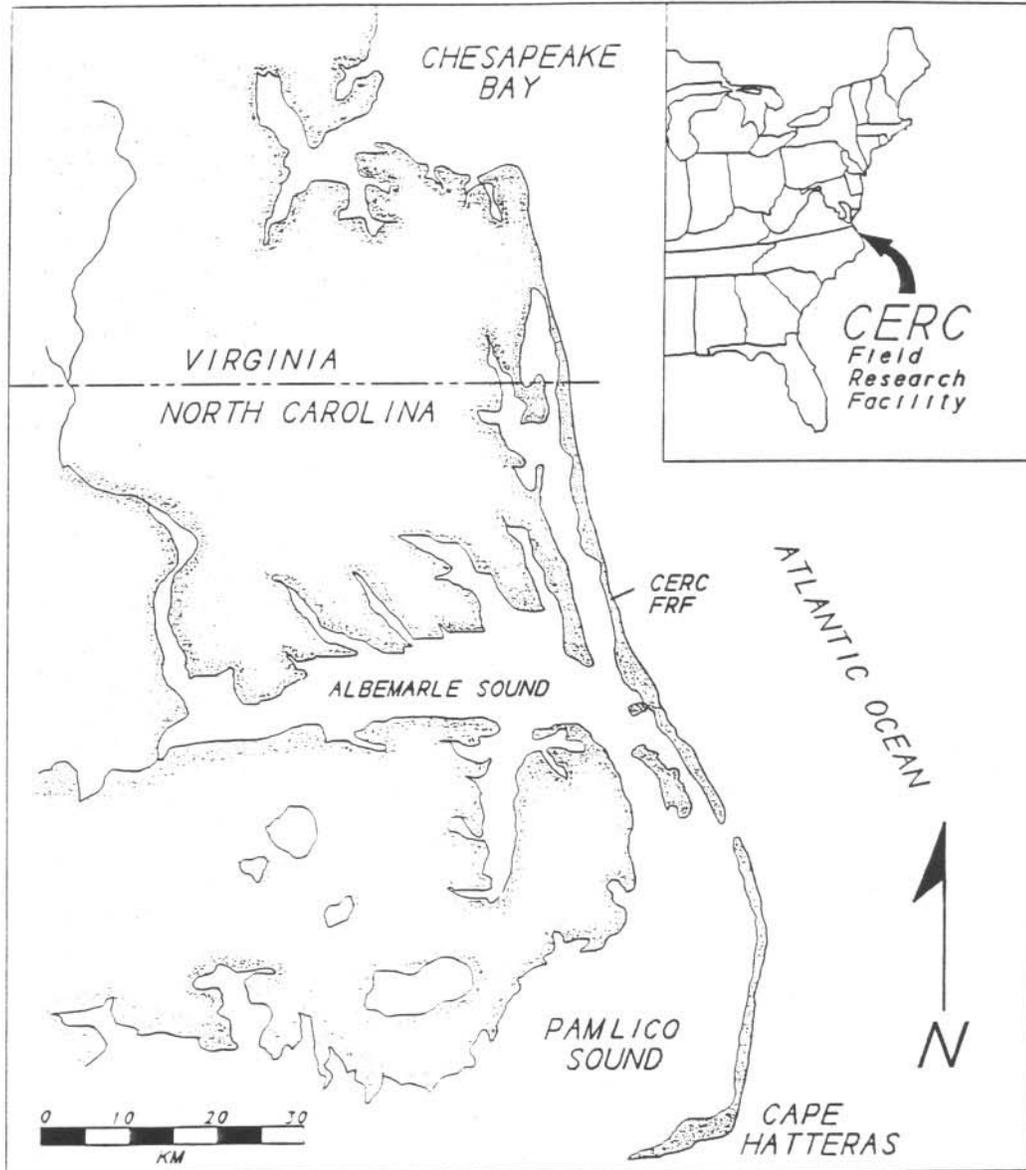


Figure 1. FRF Location Map

Table 1: Instrument Status/Data Availability

DECEMBER 1992

Gage ID	Description/Remarks	Depth at Sensor		Day of the month																														
				1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	2	2	2	2	2	2	3	3	
616	Barometric Pressure		Gage Status	*****																														
			Data Collected	***** / *****																														
604	Precipitation		Gage Status	*****																														
			Data Collected	*****																														
624	Air Temperature		Gage Status	*****																														
			Data Collected	***** / ***** - - - -																														
932	Anemometer at seaward end of pier Elevation 19 m (NGVD)		Gage Status	*****																														
			Data Collected	***** / *****																														
625	Baylor staff at station 18+60 on FRF pier	see Figure 7	Gage Status	*****																														
			Data Collected	***** / *****																														
111	Pressure gage 309 m north of FRF pier (0.9 km offshore)	Approx. 7.8 m NGVD	Gage Status	*****																														
			Data Collected	***** / *****																														
630	Waverider buoy 4.0 km offshore	Approx. 17 m NGVD	Gage Status	*****																														
			Data Collected	***** / *****																														
519	Current meter 320 m north of FRF pier (0.9 km offshore)	see Figure 7	Gage Status	***** / /																														
			Data Collected	***** / ***** / /																														
865-1370	NOAA tide station at seaward end of FRF pier		Gage Status	*****																														
			Data Collected	***** / *****																														
Supplemental Observations (daily oceanographic and meteorological observations)			Daily observation	*****																														

Gage Status
Operational = *
Partial = /
Non-Operational = -

Daily Observation
Complete = *
Partial = /
None = -

Data Collected
All = *
Partial = /
None = -

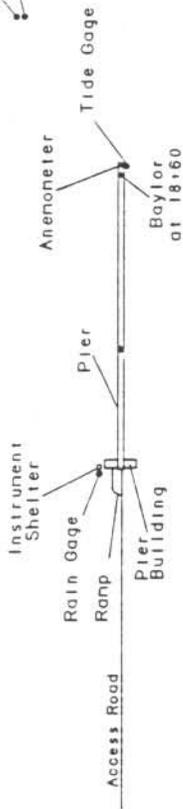


Pier Building at 0+40 to 1+00

12 inch Rain Gage at 0+30

Instrument Shelter at 0+40

Current Meter
320 n north of pier
Pressure Gage
309 n north of pier



Off shore
Waverider Buoy

CURRITUCK SOUND

ATLANTIC OCEAN

Off shore
Waverider Buoy
(No. 630)

Pier Deck 7.6 m
Baylor Gage (No. 625) at 18+60

Anemometer 19m (No. 932)
Tide Gage (No. 665-1370) at 18+60

Current Meter (No. 519) north of pier

Pressure Gage
(No. 111) north of pier

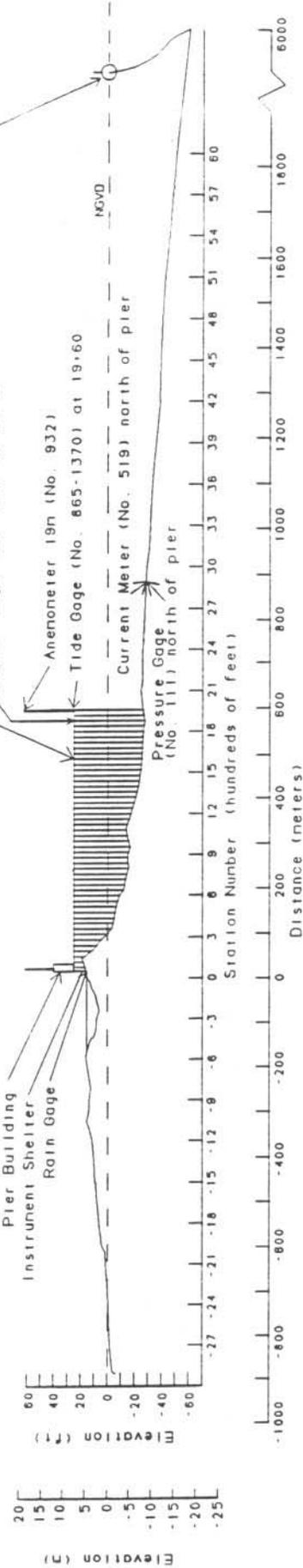


Figure 2. Instrument locations at FRF (all elevations from NGVD, all distances from PRF baseline).

PART II: METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Figure 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

Winds were measured at the end of the pier at an elevation of 19 m (Figure 2) using a WeatherMeasure Skyvane anemometer.

Monthly resultant wind speeds and directions are determined by vector averaging the data. Wind directions indicate where the wind is coming from. Temperature and atmospheric pressure means are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in.) -
 $\text{mm} \times .03937 = \text{in.}$
2. Millibars (mb) to inches of mercury (in. Hg) -
 $\text{mb} \times 0.02953 = \text{in. Hg}$
3. Degrees Celsius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $\text{m/s} \times 1.943 = \text{kn}$

Table 2: Meteorological Data

Dec 1992

Day	Hour	Wind Speed	Wind Direction	Temperature		Atm Pressure	Precipitation
		m/sec	deg TN	deg C	mb	mm	
1	100	3	179	8.5	1011.2	0	
	700	3	191	9.5	1010.1	0	
	1300	4	238	13.0	1007.4	0	
	1900	9	295	9.6	1010.0	0	
2	100	6	293	5.0	1011.5	0	
	700	3	203	6.1	1012.0	0	
	1300	5	185	12.4	1006.1	0	
	1900	10	265	7.7	1007.7	0	
3	100	10	285	6.2	1010.7	0	
	700	8	277	4.3	1015.6	0	
	1300	6	267	9.6	1018.0	0	
	1900	2	303	6.1	1020.8	0	
4	100	4	302	5.4	1022.0	0	
	700	0		4.5	1022.4	0	
	1300	5	200	8.9	1019.4	0	
	1900	8	193	11.2	1015.0	0	
5	100	8	233	13.4	1008.4	0	
	700	8	270	12.3	1007.4	0	
	1300	14	295	7.7	1010.2	0	
	1900	12	310	3.4	1017.5	0	
6	100	11	318	0.9	1022.1	0	
	700	7	277	0.0	1024.0	0	
	1300	1	268	5.8	1022.3	0	
	1900	5	226	6.6	1020.4	0	
7	100	7	226	6.6	1015.2	0	
	700	7	258	6.3	1013.4	0	
	1300	4	332	10.4	1011.8	0	
	1900	7	2	8.9	1013.6	0	
8	100	9	5	7.5	1015.5	0	
	700	8	8	6.7	1017.7	0	
	1300	8	351	6.6	1017.9	0	
	1900	11	357	6.1	1019.4	0	
9	100	11	2	6.0	1020.6	0	
	700	11	17	6.8	1023.3	0	
	1300	9	16	6.6	1024.2	0	
	1900	8	29	6.2	1024.3	0	
10	100	9	67	10.5	1021.1	0	
	700	11	118	13.4	1014.5	0	
	1300	14	126	18.5	1005.0	0	
	1900	3	172	17.8	995.3	31	
11	100	9	252	9.8	993.6	0	
	700	8	261	11.5	993.4	0	
	1300	10	250	9.5	993.5	0	
	1900	7	267	8.9	995.7	0	
12	100	8	280	9.1	996.9	0	
	700	13	345	12.6	1000.2	0	
	1300	15	333	7.7	1004.8	0	
	1900	11	324	7.6	1008.4	0	
13	100	13	331	7.0	1011.1	0	
	700	16	343	6.9	1014.9	0	
	1300	14	345	7.6	1016.6	0	
	1900	14	343	7.5	1020.3	0	
14	100	12	356	8.5	1020.9	0	
	700	10	358	7.7	1022.4	0	
	1300	11	1	8.5	1022.7	0	
	1900	10	352	8.4	1023.4	0	
15	100	11	338	7.6	1022.2	0	
	700	8	3	8.7	1023.4	0	
	1300	6	1	9.1	1022.0	0	
	1900	4	27	9.7	1022.2	0	
16	100	2	12	10.1	1021.4	0	
	700	4	158	10.8	1020.6	5	
	1300	5	161	14.3	1019.5	0	
	1900	6	188	14.3	1020.0	0	

* electronic problems

(Continued)

(Sheet 1 of 2)

Table 2: Meteorological Data

Dec 1992

Day	Hour	Wind Speed	Wind Direction	Temperature		Atm Pressure	Precipitation
		m/sec	deg TN	deg C	mb	mm	
17	100	5	193	15.7	1017.7	0	
	700	4	187	16.7	1014.9	0	
	1300	7	195	17.8	1011.1	0	
	1900	6	214	15.1	1009.8	0	
18	100	7	3	10.2	1015.8	0	
	700	4	1	10.4	1020.1	0	
	1300	7	8	10.1	1022.6	0	
	1900	7	72	9.4	1024.1	0	
19	100	6	47	9.9	1024.0	0	
	700	5	11	10.5	1024.0	0	
	1300	3	349	11.6	1021.1	0	
	1900	4	241	12.7	1020.7	0	
20	100	2	166	12.6	1016.4	0	
	700	5	208	14.3	1013.9	0	
	1300	8	236	17.4	1011.2	5	
	1900	5	345	15.7	1016.1	0	
21	100	12	358	10.1	1020.5	0	
	700	11	22	7.4	1024.2	0	
	1300	6	1	7.8	1024.0	0	
	1900	5	52	8.5	1022.8	0	
22	100		Hardware Error				0
	700					0	
	1300	3	245	10.0	1018.2	0	
	1900	2	288	8.8	1019.9	0	
23	100	2	208	10.3	1018.5	0	
	700	5	208	12.1	1016.8	0	
	1300	6	252	15.3	1013.8	0	
	1900	3	1	16.3	1015.4	0	
24	100	4	266	13.4	1013.4	0	
	700	6	273	11.6	1013.8	0	
	1300	14	332	8.1	1021.3	0	
	1900	11	326	1.4	1030.7	0	
25	100	5	20	1.7	1030.5	0	
	700	2	91	3.3	1029.3	0	
	1300	2	118	6.9	1024.6	0	
	1900	2	224	7.1	1021.6	0	
26	100	3	272	10.1	1018.4	0	
	700	4	278	8.3	1020.8	0	
	1300	7	352	8.1	1023.9	0	
	1900	7	29	7.3	1029.1	0	
27	100	10	18	5.6	1033.1	0	
	700	9	48	5.0	1035.6	0	
	1300	11	29	7.6	1034.6	0	
	1900	7	43	9.6	1033.2	0	
28	100	6	102		1029.1	0	
	700	8	100		1027.3	0	
	1300	7	95		1025.6	5	
	1900	11	55	Gage	1025.7	6	
29	100	5	25	Inoperative	1024.0	0	
	700	8	58		1023.6	3	
	1300	6	1		1022.3	6	
	1900	4	355		1023.1	0	
30	100	2	1		1021.8	0	
	700	2	237		1022.7	0	
	1300	3	235		1020.4	0	
	1900	4	212		1020.0	0	
31	100	6	233		1017.6	0	
	700	8	236		1017.5	0	
	1300	5	240		1014.5	0	
	1900	6	226		1014.6	0	
		Resultant		Mean	Mean	Total	
		3	328	9.2	1017.7	61	

* electronic problems

PART III: WAVE DATA

Wave data are collected from a Baylor staff gage (Gage 625), a pressure wave gage (Gage 111) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on optical disc using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 3 hr. The sampling rate is two times per second for five contiguous 34-min records. This report reflects the data collection periods of 0100, 0700, 1300, and 1900 EST. The results are based only on the first 34 minute record.

Wave height H_{mo} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum. When this analysis is complete, the data are written to optical disc.

Table 3 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed from this data. Figure 3 is a time history of all H_{mo} and T_p values obtained for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, the presence of multiple wave trains containing nearly equal energy, and statistical variations in spectral estimations.

Table 3: Wave Data

Dec 1992

Day	Hour	625		111		630	
		Baylor at 18+60 Hmo,m	TP,sec	Pressure Gage Hmo,m	TP,sec	Offshr Hmo,m	Wvdr TP,sec
1	0100	0.32	9.14	0.35	9.48	0.40	9.48
	0700	0.35	9.14	0.38	9.14	0.41	9.48
	1300	0.31	9.48	0.34	9.85	0.43	9.14
	1900	0.64	3.77	0.62	3.88	0.83	4.00
2	0100	0.50	3.77	0.49	3.51	0.71	3.82
	0700	0.43	4.57	0.42	4.49	0.50	4.92
	1300	0.36	9.14	0.34	9.14	0.52	8.83
	1900	0.36	17.07	0.29	8.83	0.54	9.48
3	0100	0.35	16.00	0.34	16.00	0.68	2.69
	0700	0.44	3.82	0.41	16.00	0.69	4.20
	1300	0.42	15.06	0.42	4.27	0.58	3.66
	1900	0.41	9.85	0.38	15.06	0.48	8.53
4	0100	0.41	4.74	0.40	4.83	0.51	5.22
	0700	0.46	5.69	0.41	5.57	0.57	5.22
	1300	0.41	11.13	0.43	7.31	0.55	5.45
	1900	0.47	11.13	0.41	10.24	0.53	12.19
5	0100	0.42	11.64	0.40	11.13	0.50	11.13
	0700	0.32	10.67	0.31	12.19	0.40	11.64
	1300	0.98	5.82	1.05	5.69	1.48	5.57
	1900	1.25	5.95	1.34	5.95	1.56	6.74
6	0100	1.33	6.56	1.41	5.95	1.59	5.82
	0700	1.28	6.92	1.38	6.92	1.54	6.74
	1300	1.05	9.48	1.21	9.48	1.20	8.83
	1900	0.64	5.69	0.65	7.76	0.79	7.31
7	0100	0.39	8.00	0.38	8.26	0.51	7.53
	0700	0.28	11.13	0.28	10.67	0.36	11.13
	1300	0.32	11.64	0.28	11.64	0.31	11.64
	1900	0.69	4.34	0.71	4.20	0.88	4.27
8	0100	1.14	5.82	1.11	5.57	1.33	5.69
	0700	1.08	5.95	1.09	6.40	1.35	5.95
	1300	1.06	5.82	0.99	5.45	1.26	5.82
	1900	1.07	6.09	1.20	4.57	1.37	5.12
9	0100	1.25	5.45	1.27	5.22	1.51	5.12
	0700	1.33	5.82	1.46	5.69	1.62	5.95
	1300	1.60	7.11	1.66	7.11	1.87	6.92
	1900	1.25	6.74	1.31	6.74	1.60	6.92
10	0100	1.08	5.02	1.05	4.41	1.21	6.56
	0700	1.06	4.06	0.99	4.57	1.23	4.49
	1300	2.22	7.31	2.31	7.11	2.67	7.31
	1900	3.22	9.85	3.59	9.48	4.13	9.85
11	0100	2.38	11.13	2.45	11.64	3.04	11.64
	0700	1.89	12.19	2.13	11.64	2.36	11.64
	1300	1.27	11.13	1.39	11.13	1.56	11.13
	1900	1.03	11.13	1.30	11.13	1.48	11.13
12	0100	1.17	12.80	1.35	10.67	1.39	12.19
	0700	1.74	12.19	1.92	12.80	2.08	10.67
	1300	2.34	12.19	2.63	6.56	2.92	12.19
	1900	2.51	12.19	2.87	12.19	3.23	12.80
13	0100	2.64	14.22	3.23	13.47	3.29	13.47
	0700	2.70	12.80	3.15	13.47	3.50	13.47
	1300	2.73	14.22	3.17	14.22	3.52	14.22
	1900	2.79	13.47	3.72	14.22	3.87	13.47
14	0100	2.89	15.06	3.97	15.06	4.41	14.22
	0700	3.00	16.00	3.81	15.06	4.23	14.22
	1300	3.04	15.06	4.00	16.00	4.41	16.00
	1900	2.78	15.06	3.90	15.06	4.37	16.00
15	0100	3.09	16.00	3.86	17.07	3.96	16.00
	0700	2.93	15.06	3.68	15.06	3.42	16.00
	1300	2.78	16.00	2.91	15.06	3.01	15.06
	1900	2.54	14.22	2.79	15.06	2.56	15.06
16	0100	1.97	14.22	2.11	13.47	2.21	13.47
	0700	2.22	14.22	2.17	14.22	2.09	14.22
	1300	1.94	14.22	1.98	14.22	2.01	14.22
	1900	1.62	14.22	1.75	12.80	1.69	12.80

* Electronic problems

(Continued)

(Sheet 1 of 2)

Table 3: Wave Data

Dec 1992

Day	Hour	625		111		630	
		Baylor at 18+60 Hmo,m	18+60 Tp,sec	Pressure Gage Hmo,m	Pressure Gage Tp,sec	Offshsr Hmo,m	Wvrdr Tp,sec
17	0100	1.42	13.47	1.47	13.47	1.66	13.47
	0700	1.41	12.80	1.37	12.80	1.35	12.19
	1300	1.16	12.80	1.34	12.19	1.37	11.64
	1900	1.00	12.19	1.03	12.80	1.15	11.64
18	0100	0.92	12.19	0.87	11.64	1.12	11.64
	0700	0.76	11.64	0.80	11.13	0.87	10.67
	1300	1.28	6.09	1.31	6.40	1.55	5.82
	1900	1.13	6.56	1.09	6.09	1.29	6.40
19	0100	0.94	6.40	0.87	6.40	1.20	6.40
	0700	0.90	5.82	0.83	4.74	0.97	4.74
	1300	0.69	10.67	0.69	4.74	0.81	10.67
	1900	0.69	4.74	0.64	4.92	0.76	5.02
20	0100	0.75	5.95	0.75	5.33	0.91	5.69
	0700	0.74	6.56	0.76	6.40	1.02	6.24
	1300	0.62	6.40	0.63	6.24	0.74	6.24
	1900	0.42	6.92	0.43	6.92	0.55	6.74
21	0100	0.94	4.06	0.98	4.06	1.26	4.20
	0700	1.34	5.57	1.46	5.95	1.85	6.09
	1300	1.20	6.92	1.24	6.92	1.48	7.31
	1900	0.82	5.82	0.81	5.82	1.08	6.56
22	0100			Hardware Error			
	0700	0.56	10.24	0.58	10.24	0.62	10.67
	1300	0.54	9.85	0.55	9.85	0.61	9.85
	1900	0.46	9.48	0.48	9.85	0.56	9.85
23	0100	0.49	9.48	0.53	9.14	0.57	9.48
	0700	0.45	6.92	0.51	9.14	0.62	8.00
	1300	0.40	9.14	0.38	8.83	0.50	9.14
	1900	0.33	6.09	0.37	9.14	0.53	5.69
24	0100	0.32	8.53	0.35	7.76	0.43	9.14
	0700	0.28	14.22	0.33	13.47	0.42	5.82
	1300	1.21	5.57	1.39	5.69	1.69	5.57
	1900	1.59	7.53	1.71	6.92	1.95	8.00
25	0100	1.13	5.45	1.11	5.95	1.36	7.53
	0700	1.01	8.83	0.99	9.48	1.18	9.48
	1300	0.81	8.00	0.79	7.76	0.91	7.31
	1900	0.67	6.40	0.69	6.40	0.80	6.56
26	0100	0.44	7.76	0.43	10.24	0.50	8.00
	0700	0.31	10.24	0.36	9.14	0.41	5.57
	1300	0.66	3.77	0.58	3.82	0.64	4.34
	1900	0.79	3.94	0.77	4.20	0.91	5.12
27	0100	1.55	5.95	1.61	6.09	1.77	6.09
	0700	1.32	6.40	1.44	6.09	1.64	6.74
	1300	1.23	5.95	1.29	4.57	1.43	5.33
	1900	1.24	5.69	1.36	5.82	1.58	5.82
28	0100	1.12	6.24	1.15	5.82	1.34	6.74
	0700	1.32	6.56	1.38	6.74	1.72	7.11
	1300	1.60	8.53	1.67	8.00	1.87	8.26
	1900	1.77	8.53	1.99	8.83	2.31	8.53
29	0100	1.86	8.83	1.87	8.83	2.17	8.83
	0700	2.34	9.85	2.39	9.85	2.87	9.85
	1300	2.25	10.24	2.36	10.24	2.87	10.24
	1900	1.94	10.24	1.67	9.85	2.32	10.24
30	0100	1.59	9.85	1.41	9.48	1.90	9.48
	0700	1.33	9.85	1.11	9.48	1.61	9.14
	1300	1.00	9.85	0.96	9.85	1.29	9.48
	1900	1.01	9.85	0.75	9.85	1.27	9.85
31	0100	0.90	10.24	0.82	9.85	1.06	10.24
	0700	0.73	9.85	0.68	9.85	0.90	9.85
	1300	0.58	9.48	0.57	9.85	0.73	9.85
	1900	0.52	9.48	0.50	9.48	0.59	9.14
	Mean	1.20	9.20	1.30	9.04	1.49	8.79
	Std dev	0.78	3.46	0.97	3.45	1.02	3.25

* Electronic problems

(Sheet 2 of 2)

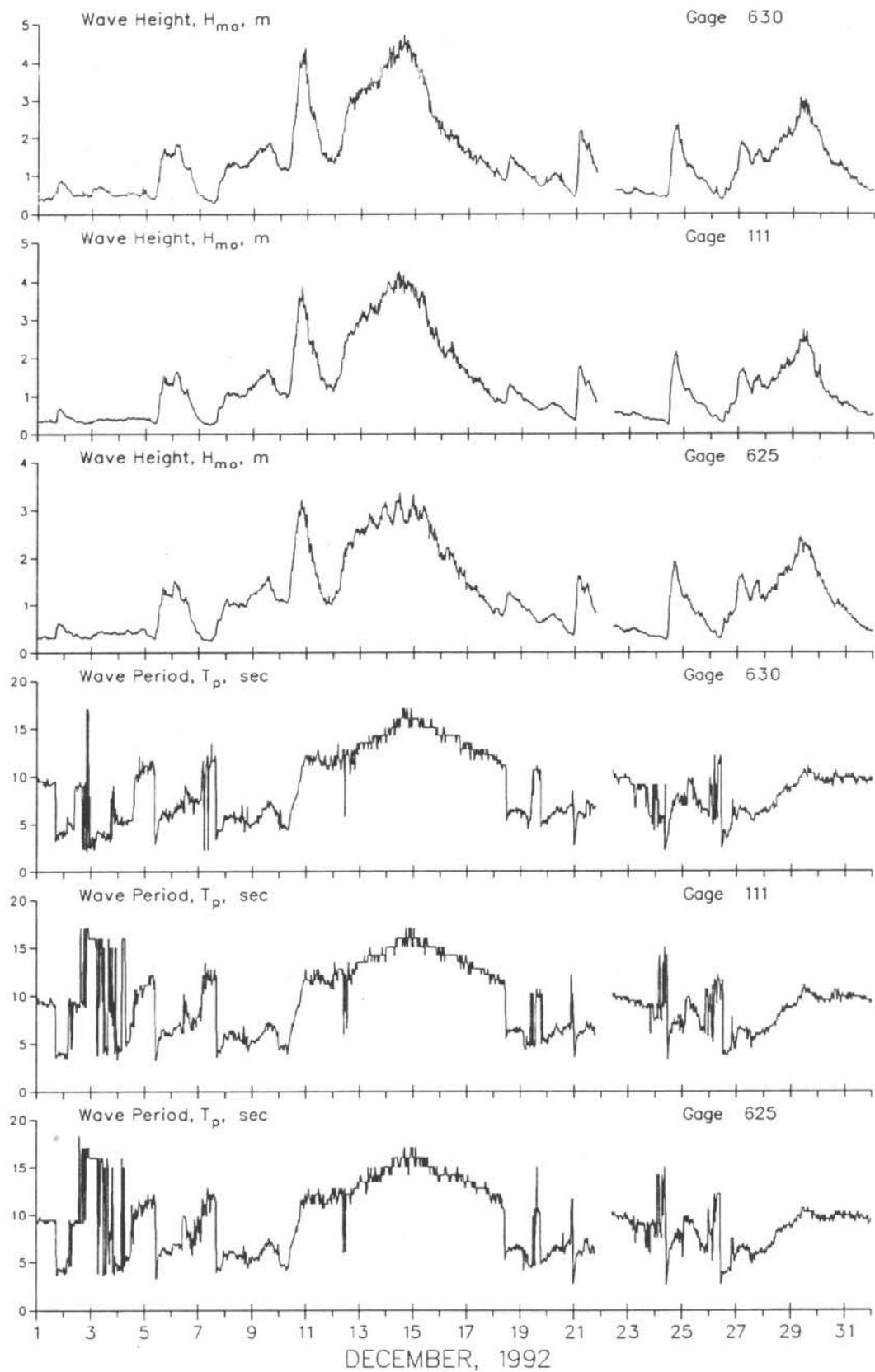


Figure 3. Time history of wave heights and periods

PART IV: CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the cross-shore and longshore data. Current directions indicate the direction that the current is moving towards.

IMPORTANT NOTE

Direction resultants regarding the current meter data (gages 519 and 529) may be in error by minus 5 degrees due to a faulty compass reading. Please call us if you must use this data.

Table 4: Current Data
Dec 1992

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519	
			Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface)		Dye 12m offshore (surface)			Speed	Dir
			Speed	Dir	Distance from Baseline (m)	Speed	Dir	Location	Speed		
1	0100	-Along Cross Result								2 1 2	S off 139
1	0700	-Along Cross Result	24 6 25	N off 354	140	47 0 47	N 340	South	8 N	7 2 7	N on 322
1	1300	-Along Cross Result								5 2 5	N on 321
1	1900	-Along Cross Result								3 2 4	S off 120
2	0100	-Along Cross Result								27 8 28	S off 144
2	0700	-Along Cross Result	30 8 31	N off 354	140	47 0 47	N 340	South	0	10 9 14	S off 118
2	1300	-Along Cross Result								3 2 3	S off 133
2	1900	-Along Cross Result								6 1 6	S off 147
3	0100	-Along Cross Result								10 3 11	S off 146
3	0700	-Along Cross Result	14 7 15	S off 133	140	28 8 29	S off 143	North	5 S	8 4 9	S off 134
3	1300	-Along Cross Result								1 1 2	N on 293
3	1900	-Along Cross Result								9 7 12	S off 121
4	0100	-Along Cross Result								1 1 1	off 70
4	0700	-Along Cross Result	15 8 17	N off 7	140	16 4 16	S off 146	South	9 N	4 3 5	S off 123
4	1300	-Along Cross Result								9 6 11	N on 305
4	1900	-Along Cross Result								9 5 10	N on 310
5	0100	-Along Cross Result								18 6 19	N on 322
5	0700	-Along Cross Result	27 33 42	S off 109	152	51 10 52	S off 149	North	12 S	15 2 15	N on 332
5	1300	-Along Cross Result								11 7 13	S off 129
5	1900	-Along Cross Result								31 14 34	S off 135

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Dec 1992

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519	
			Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline (m)		Dye 12m offshore (surface)			Speed	Dir
			Speed	Dir	Speed	Dir	Location	Speed	Dir		
6	0100	-Along Cross Result								21 10 23	S off 134
6	0700	-Along Cross Result	41 8 41	S off 149	152	51 13 52	S on 174	North	30	28 15 32	S off 131
6	1300	-Along Cross Result								13 18 22	S off 107
6	1900	-Along Cross Result								10 8 13	S off 122
7	0100	-Along Cross Result								17 1 17	N off 344
7	0700	-Along Cross Result	15 11 19	N off 17	152	0 8 8	off 70	South	20	15 2 15	N off 349
7	1300	-Along Cross Result								6 4 7	N off 16
7	1900	-Along Cross Result								11 10 14	S off 117
8	0100	-Along Cross Result								13 10 16	S off 121
8	0700	-Along Cross Result	55 0 55	N off 340	140	76 0 76	S on 160	North	49	18 12 22	S off 125
8	1300	-Along Cross Result								21 12 24	S off 129
8	1900	-Along Cross Result								30 16 34	S off 132
9	0100	-Along Cross Result								34 14 37	S off 138
9	0700	-Along Cross Result	76 0 76	S off 160	165	102 51 114	S on 187	North	20	38 18 42	S off 134
9	1300	-Along Cross Result								41 19 46	S off 135
9	1900	-Along Cross Result								38 17 42	S off 136
10	0100	-Along Cross Result								23 15 28	S off 126
10	0700	-Along Cross Result	44 9 44	N on 329	140	87 0 87	N on 340	South	71	7 11 13	S off 101
10	1300	-Along Cross Result								25 7 26	N off 355
10	1900	-Along Cross Result								53 7 53	N off 347

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Dec 1992

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements			Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519			
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
11	0100	-Along Cross Result								7	S	
										9	off	
										11	109	
11	0700	-Along Cross Result	0 8 8	off 70	189	55 14 57	N off 354	South	66	N	6 11 13	S off 98
11	1300	-Along Cross Result									20 12 23	S off 130
11	1900	-Along Cross Result									14 13 19	S off 117
12	0100	-Along Cross Result									31 14 34	S off 135
12	0700	-Along Cross Result	122 30 126	S on 174	238	203 0 203	S on 160	no observation			38 19 42	S off 133
12	1300	-Along Cross Result									80 34 87	S off 137
12	1900	-Along Cross Result									53 28 60	S off 132
13	0100	-Along Cross Result									70 34 78	S off 134
13	0700	-Along Cross Result	102 25 105	S on 174	238	102 76 127	S on 197	no observation			82 35 89	S off 137
13	1300	-Along Cross Result									100 42 109	S off 137
13	1900	-Along Cross Result									80 40 89	S off 133
14	0100	-Along Cross Result									87 46 99	S off 132
14	0700	-Along Cross Result	87 22 90	S on 174	226	102 76 127	S on 197	no observation			51 32 60	S off 128
14	1300	-Along Cross Result									55 40 68	S off 124
14	1900	-Along Cross Result									24 19 31	S off 121
15	0100	-Along Cross Result									26 24 35	S off 117
15	0700	-Along Cross Result	0 0 0	0	165	38 10 39	N off 354	no observation			6 22 23	S off 86
15	1300	-Along Cross Result									8 15 17	S off 98
15	1900	-Along Cross Result									13 12 18	S off 118

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Dec 1992

Day	Time	Alongshore Cross-shore Resultant ----- Time	Pier Measurements					Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519			
			Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline		Dye 12m offshore (surface)			Speed	Dir			
			Speed	Dir	Speed	Dir	Location	Speed	Dir	Speed	Dir			
16	0100	-Along Cross Result									16	S	0	
16	0700	-Along Cross Result	9 0 9	N off 340	189	87 0 87	N off 340	South	32	N	12 9 15	N off 17	160	
16	1300	-Along Cross Result									9 15 17	N off 40		
16	1900	-Along Cross Result									15 12 19	N off 18		
17	0100	-Along Cross Result									12 3 12	N off 355		
17	0700	-Along Cross Result	41 6 41	N off 349	165	102 0 102	N off 340	South	51	N	11 0 11	N off 340		
17	1300	-Along Cross Result									16 2 16	N on 333		
17	1900	-Along Cross Result									11 2 11	N on 330		
18	0100	-Along Cross Result									9 10 14	N off 28		
18	0700	-Along Cross Result	6 3 7	S on 187	140	38 11 40	S on 177	North	0		0 13 13	off 70		
18	1300	-Along Cross Result									13 7 15	N off 11		
18	1900	-Along Cross Result									2 10 10	S off 79		
19	0100	-Along Cross Result									10 6 12	N off 10		
19	0700	-Along Cross Result	3 3 5	N off 25	140	44 0 44	S off 160	North	0		6 9 10	N off 36		
19	1300	-Along Cross Result									5 4 6	N off 21		
19	1900	-Along Cross Result									11 10 15	S off 116		
20	0100	-Along Cross Result									16 8 17	S off 133		
20	0700	-Along Cross Result	17 17 24	N off 25	177	61 15 63	N off 354	North	3	N	16 12 20	S off 122		
20	1300	-Along Cross Result									6 2 6	N off 356		
20	1900	-Along Cross Result									4 19 19	N off 57		

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N = Northward, Shore parallel
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on = onshore off = offshore

Table 4: Current Data (Continued)
Dec 1992

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Location	Speed	Dir	Speed	Dir
21	0100	-Along Cross Result									14 10 17	S off 126
21	0700	-Along Cross Result	34 0 34	S off 160	165	61 15 63	S on 174	North	15	S	31 18 36	S off 130
21	1300	-Along Cross Result									18 15 23	S off 119
21	1900	-Along Cross Result									18 13 22	S off 125
22	0100	-Along Cross Result										
22	0700	-Along Cross Result	16 16 23	S off 115	152	32 24 40	N off 17	South	11	N		
22	1300	-Along Cross Result									1 6 6	S off 81
22	1900	-Along Cross Result									7 11 13	S off 100
23	0100	-Along Cross Result									12 9 15	S off 124
23	0700	-Along Cross Result	25 13 28	N off 7	140	38 10 39	N off 354	South	18	N	2 7 7	S off 89
23	1300	-Along Cross Result									1 4 4	N off 54
23	1900	-Along Cross Result									2 8 9	S off 85
24	0100	-Along Cross Result									2 12 12	S off 79
24	0700	-Along Cross Result	28 8 29	S off 143	140	18 11 21	S off 129	North	27	S	1 5 5	N off 60
24	1300	-Along Cross Result									41 16 44	S off 138
24	1900	-Along Cross Result									49 21 53	S off 137
25	0100	-Along Cross Result									26 14 29	S off 131
25	0700	-Along Cross Result	12 9 15	S off 125	140	16 7 18	S off 136	North	20	S	4 5 7	N off 32
25	1300	-Along Cross Result									1 7 7	S off 78
25	1900	-Along Cross Result									10 4 10	N off 0

KEY = All speeds in cm/sec
N = Northward, Shore parallel
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on = onshore off = offshore

Table 4: Current Data (Continued)
Dec 1992

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements					Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519		
			Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed Dir		Location	Dye 12m offshore (surface)		Speed	Dir	
			Speed	Dir		Speed	Dir		Speed	Dir			
26	0100	-Along Cross Result								20	N	2	on
26	0700	-Along Cross Result	6 1 6	N on 334	140	9 5 10	S off 129	South	9 N	15 3 15	N on 329	12 13	off 54
26	1300	-Along Cross Result								4 12 13	N off 54		
26	1900	-Along Cross Result								4 6 7	N off 33		
27	0100	-Along Cross Result								27 17 32	S off 129		
27	0700	-Along Cross Result	23 8 24	S on 179	140	30 0 30	S off 160	North	24 S	22 15 27	S off 127	28 17 32	S off 129
27	1300	-Along Cross Result								23 14 27	S off 128		
27	1900	-Along Cross Result								25 17 30	S off 126		
28	0100	-Along Cross Result								12 0 12	S off 122		
28	0700	-Along Cross Result	12 0 12	S 160	165	38 15 41	N off 2	South	20 N	16 12 20	S off 122	24 18 30	S off 123
28	1300	-Along Cross Result								27 19 33	S off 125		
28	1900	-Along Cross Result								22 24 33	S off 112		
29	0100	-Along Cross Result								0 0 0	S off 126		
29	0700	-Along Cross Result	0 0 0	0	213	76 57 95	N on 303	South	40 N	25 17 31	S off 126	25 18 30	S off 124
29	1300	-Along Cross Result								5 20 20	S off 85		
29	1900	-Along Cross Result								18 22 28	S off 110		
30	0100	-Along Cross Result								8 10 13	S off 125		
30	0700	-Along Cross Result	8 10 13	N off 31	152	51 25 57	N off 7	South	20 N	8 6 10	S off 125	10 9 13	S off 120
30	1300	-Along Cross Result											
30	1900	-Along Cross Result											
											Gage Inoperative		

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N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Concluded)
Dec 1992

Day	Time	Pier Measurements					Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519	
		Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Dye 12m offshore (surface)		Location	Speed	Dir	Speed	Dir
		Speed	Dir		Speed	Dir					
31	0100	Along									Gage Inoperative
31	0700	Along	22	N		61	N	43	N		
		Cross	11	off	140	15	off	South			
		Result	24	7		63	354				
31	1300	Along								8	N
		Cross								2	off
		Result								8	356
31	1900	Along								5	N
		Cross								13	off
		Result								14	50

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
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 on = onshore off = offshore

PART V: SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves but not surface chop or capillary waves) are taken daily at the seaward end of the pier. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring the alignment of the wave crests at approximately the same location as the visual measurements. The pier axis (considered perpendicular to the beach at the FRF) is oriented 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are also taken daily at the seaward end of the pier. A Bucket Thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The temperature is then read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the depth of visibility.

Table 5: Supplemental Observations

Dec 1992

Day	Time	Wave Approach Angle at Pier End deg from True N		Radar Wave Angle deg from True N	Width of Surf Zone, m	Water Characteristics at Pier End		
		Primary	Secondary			Temp., C	Density g/cc	Secchi Vis., m
1	0925	80			27	12.5	1.0220	2.1
2	0855	75	110		55	12.8	1.0227	2.4
3	0900	20			34	12.0	1.0233	1.8
4	0850	10	135	25	73	11.7	1.0228	2.1
5	1030	150		30	69	12.8	1.0241	1.5
6	1000	20		30	134	11.1	1.0245	1.2
7	0915	145			54	10.6	1.0246	1.2
8	0857	40		40	111	10.6	1.0248	0.9
9	0900	50		30	198	10.0	1.0243	0.9
10	0900	100		100	120	8.9	1.0235	0.6
11	0840	95		90	344	10.8	1.0241	0.6
12	0910	10		60	344	10.0	1.0239	0.3
13	1040	70		50	524	8.9	1.0234	0.3
14	0855	50		50	559	7.8	1.0213	0.3
15	0835	60		80	523	7.8	1.0234	0.3
16	0845	85			343	7.8	1.0241	0.9
17	0845	90			187	8.3	1.0246	0.9
18	0840	50		60	115	8.3	1.0251	1.5
19	1050	30		80	102	8.3	1.0249	1.2
20	1040	100		50	130	8.3	1.0235	0.6
21	0910	40		30	172	7.8	1.0231	1.2
22	0835	65			52	7.5	1.0223	1.8
23	0925	95	140		61	8.1	1.0220	1.8
24	0830	10			1	8.3	1.0226	1.8
25	0825	60		65	84	6.7	1.0222	0.6
26	0830	none	visible		8	7.2	1.0225	0.9
27	0930	50		50	134	7.2	1.0235	0.6
28	0915	80	55	45	131	7.2	1.0231	0.3
29	0840	80	40	95	418	7.5	1.0221	0.6
30	0830	90			158	7.5	1.0213	1.2
31	0845	90			94	8.4	1.0240	1.2

PART VI: WATER LEVELS

Since 1978, the National Oceanic and Atmospheric Administration (NOAA)/National Ocean Service (NOS) has operated a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect instantaneous water level data every 6 minutes throughout the month.

The variation in water level during the month is shown in Figure 4 along with a list of mean and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water level.

Table 6 contains the time at the center of each 12.42-hr tidal cycle and the range, high, low, and mean water levels during each tidal cycle.

FRF Tide Heights

Dec 1992

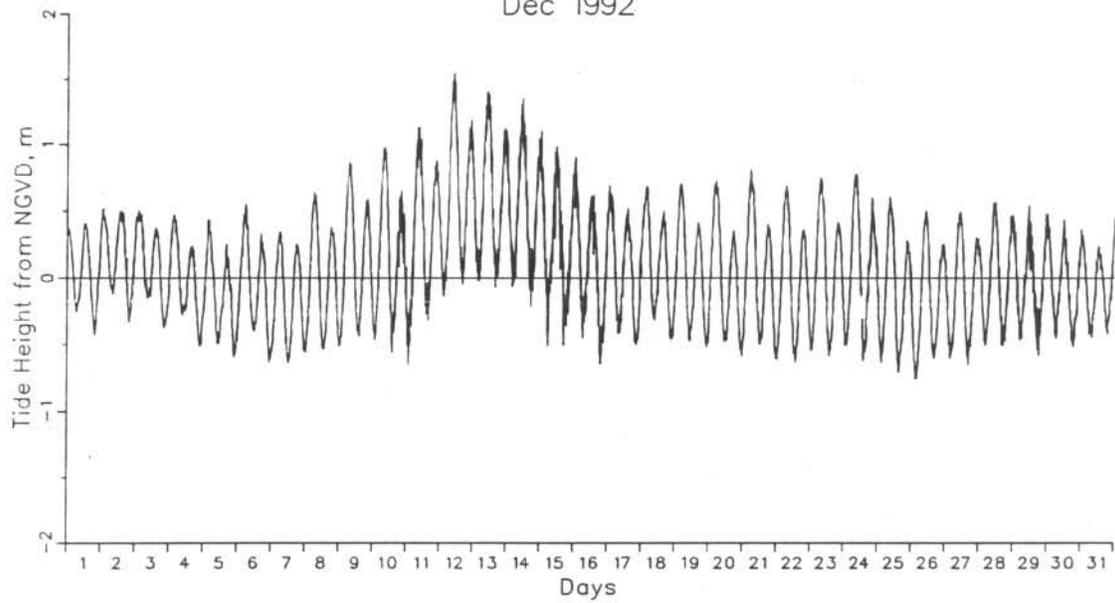


Figure 4. Water level time history

Monthly Water Levels, m NGVD

Extreme Low = -0.76 on day 26 at 206 EST
Extreme High = 1.55 on day 12 at 912 EST
Monthly Mean = 0.09
Mean Low = -0.45
Mean High = 0.71
Mean Range = 1.16

Table 6: Water Levels,m NGVD

		Dec 1992			
Mid-Cycle	Low	High	Mean	Range	
Day	Time				
1	900	-0.26	0.41	0.08	0.66
1	2125	-0.43	0.52	0.04	0.94
2	950	-0.12	0.50	0.21	0.62
2	2215	-0.33	0.50	0.14	0.83
3	1040	-0.15	0.48	0.15	0.63
3	2306	-0.37	0.47	0.02	0.84
4	1131	-0.28	0.47	0.04	0.75
4	2356	-0.51	0.44	-0.10	0.95
5	1221	-0.49	0.35	-0.11	0.84
6	46	-0.59	0.48	-0.12	1.07
6	1312	-0.40	0.55	0.00	0.95
7	137	-0.63	0.34	-0.16	0.97
7	1402	-0.63	0.34	-0.17	0.98
8	227	-0.56	0.64	-0.05	1.20
8	1452	-0.54	0.62	-0.02	1.16
9	318	-0.51	0.86	0.08	1.37
9	1543	-0.43	0.85	0.15	1.28
10	408	-0.46	0.98	0.18	1.44
10	1633	-0.56	0.96	0.17	1.51
11	458	-0.65	1.13	0.21	1.78
11	1724	-0.31	1.04	0.35	1.36
12	549	-0.14	1.55	0.55	1.68
12	1814	-0.05	1.49	0.64	1.53
13	639	-0.02	1.41	0.63	1.43
13	1904	-0.07	1.38	0.60	1.45
14	730	-0.07	1.35	0.59	1.42
14	1955	-0.21	1.18	0.49	1.39
15	820	-0.51	1.10	0.36	1.61
15	2045	-0.51	0.88	0.22	1.39
16	910	-0.45	0.91	0.18	1.36
16	2135	-0.65	0.69	0.04	1.34
17	1001	-0.41	0.63	0.10	1.05
17	2226	-0.50	0.59	0.03	1.09
18	1051	-0.32	0.69	0.15	1.00
18	2316	-0.46	0.68	0.04	1.14
19	1141	-0.47	0.71	0.07	1.18
20	7	-0.52	0.71	0.03	1.23
20	1232	-0.48	0.73	0.04	1.20
21	57	-0.58	0.75	-0.02	1.33
21	1322	-0.50	0.81	0.08	1.31
22	147	-0.61	0.63	-0.05	1.24
22	1413	-0.63	0.69	-0.02	1.32
23	238	-0.55	0.73	0.01	1.28
23	1503	-0.58	0.75	0.04	1.33
24	328	-0.51	0.77	0.05	1.28
24	1553				
25	419	-0.63	0.60	-0.02	1.23
25	1644	-0.71	0.59	-0.11	1.30
26	509	-0.76	0.46	-0.20	1.22
26	1734	-0.61	0.50	-0.10	1.11
27	559	-0.60	0.48	-0.09	1.09
27	1825	-0.65	0.49	-0.09	1.14
28	650	-0.50	0.56	0.00	1.07
28	1915	-0.51	0.57	0.00	1.07
29	740	-0.46	0.54	0.01	1.01
29	2005	-0.58	0.48	-0.03	1.05
30	831	-0.45	0.43	0.00	0.88
30	2056	-0.52	0.37	-0.10	0.88
31	921	-0.45	0.31	-0.08	0.76
31	2146	-0.42	0.46	-0.05	0.87

PART VII: NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Geodimeter surveying system; a Geodimeter 140-T self-tracking, electronic theodolite, distance meter, in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in October 1992 and the survey in December 1992 on profile line 188, located 517 m south of the pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during 1992. Cross-hatched areas indicate changes to the annual envelope which occurred in December.

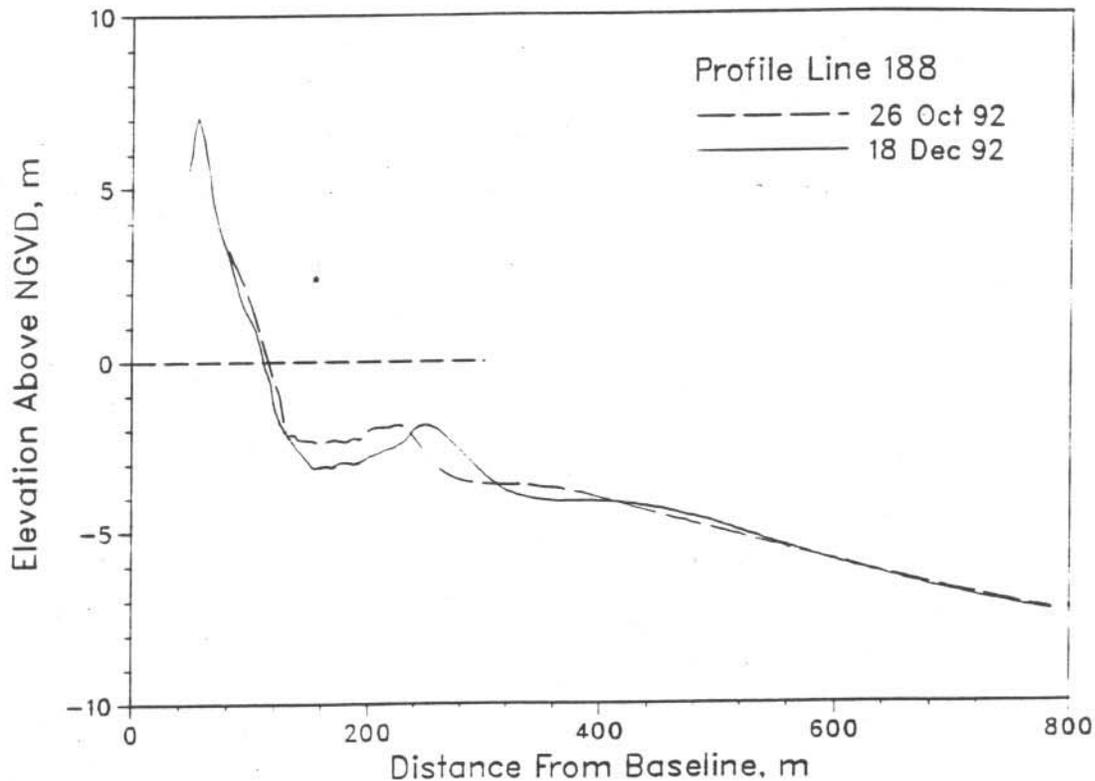


Figure 5. Monthly CRAB profiles on profile 188 - 517 m south of pier.

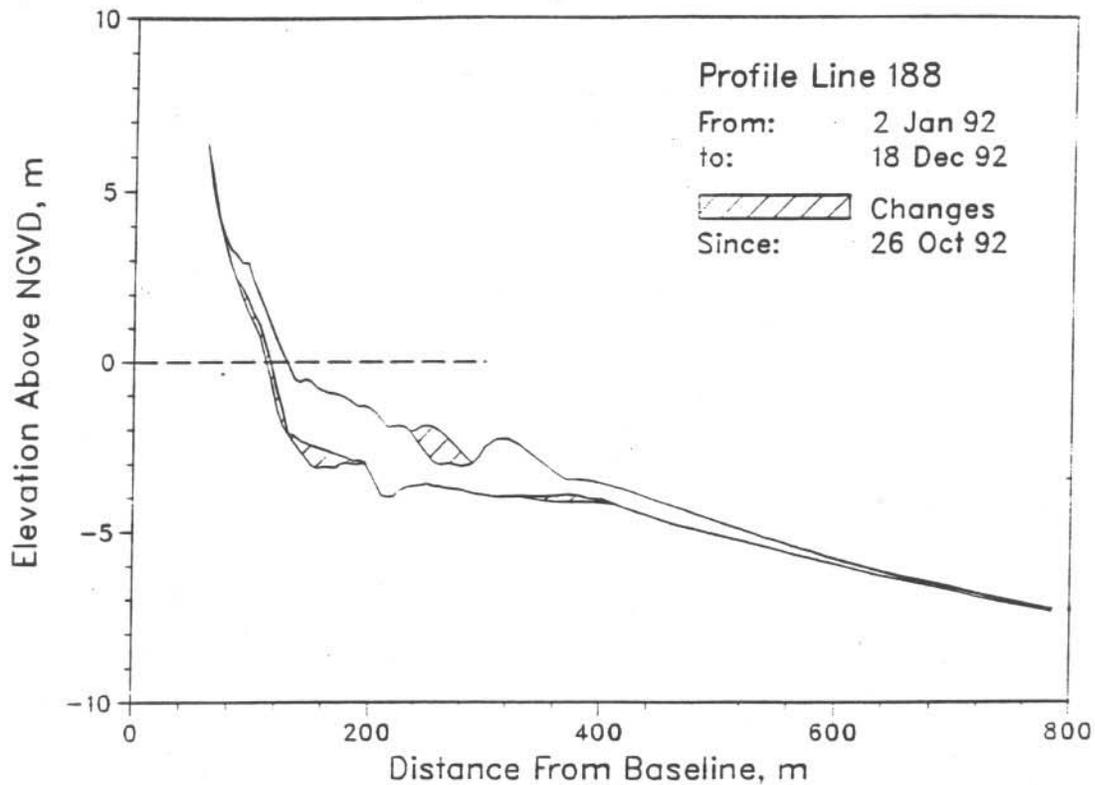


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 includes a two- and three-dimensional contour map and a change plot derived from the bathymetric survey on 18 December. Wide contour lines on the change diagram represent eroded areas; thin lines indicate deposition.

Figure 7 is included for reference. The CRAB was being upgraded at this time. There was no complete survey during the month of December.

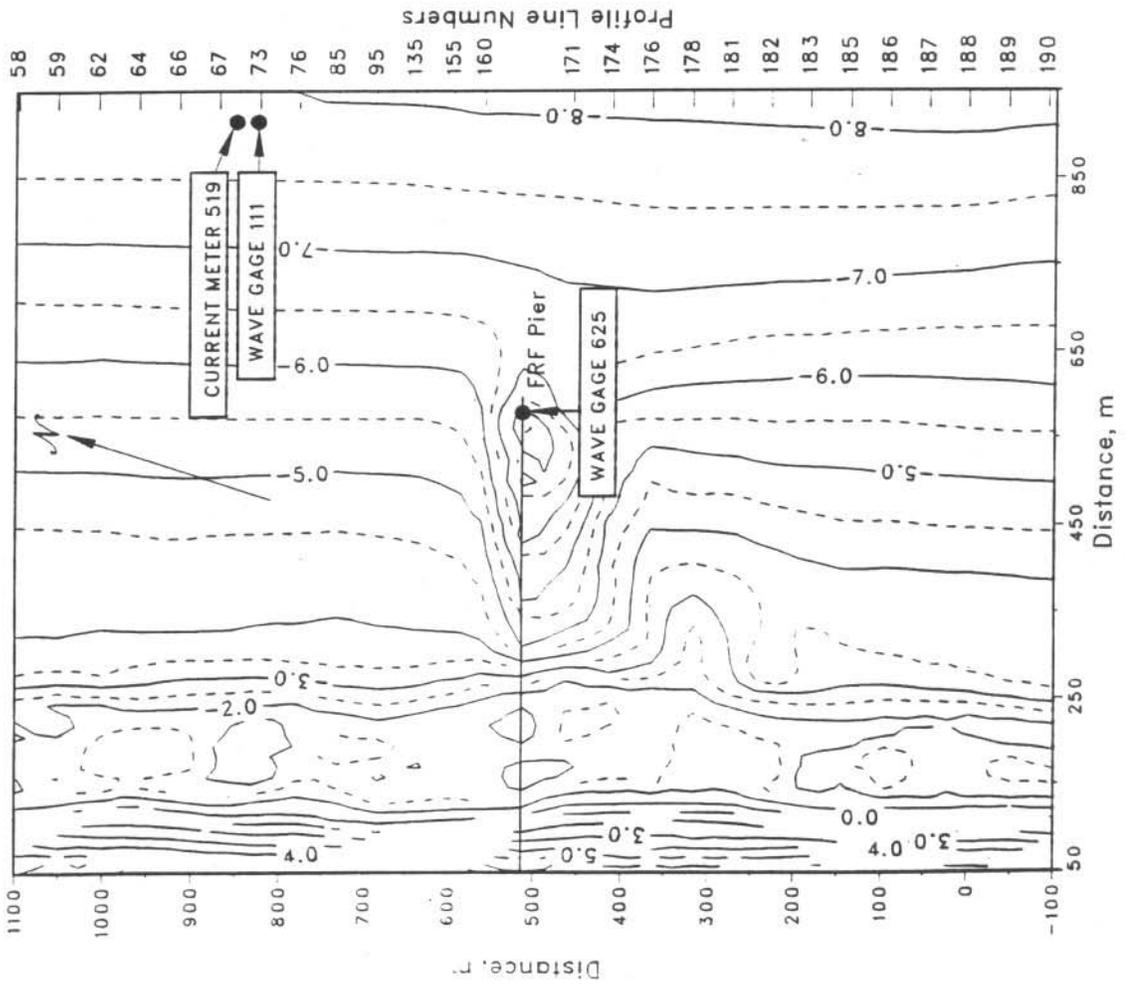
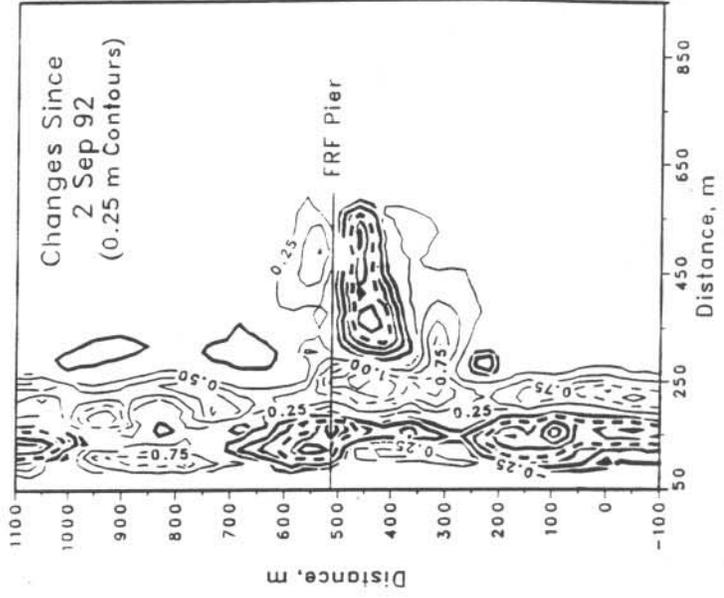
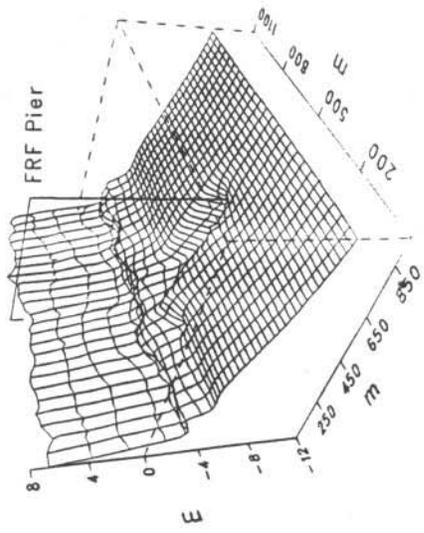


Figure 7. FRF bathymetry 26 Oct 92 depths relative to NGVD

PART VIII. SPECIAL EVENTS

A. Storm Data Collection. The following list identifies times when the wave height H_{mo} at the seaward end of the pier (i.e. as measured near the end of the pier) exceeded 2 m.

<u>Start</u>	<u>End</u>
10 December (1216)	11 December (0508)
12 December (0916)	16 December (1108)
29 December (0242)	29 December (1742)

B. Storm Synopsis.

10-11 December - Strong onshore winds were funnelled northward between a high pressure system to the northeast of the FRF and a low pressure system to the southwest of the FRF. The atmospheric pressure, fell from 1021 mb at 0100 EST on 10 December, to 994 mb by the end of the day as the storm moved over Delaware. The maximum H_{mo} at gage 630 was 4.4 m ($T_p = 11.13$ sec) at 2116 EST. Maximum onshore winds reached 19 m/s from the southeast at 1634 EST. There was 31 mm of precipitation.

12-16 December - The same low pressure system continued its northeast course until, by the morning of 12 December, it was located approximately 400 km off the New Jersey coast. At this time, the storm had evolved into a strong nor'easter with the major impact of the storm well to the north of the FRF. Winds increased at the FRF as the storm reversed itself and moved to the southeast. By the morning of 13 December the storm was located about 500 km off the Delaware coast. At this time the FRF was receiving northerly winds. There were no onshore winds but waves generated by the storm to the north reached a maximum H_{mo} , at gage 630, of 4.7 m ($T_p = 17.1$ sec) at 1408 EST on 14 December. The atmospheric pressure remained steady around 1017 mb. There was 5 mm of precipitation. By the morning of 15 December the storm was headed well out to sea.

29 December - Developing just off the northeastern coast of Florida on the morning of 28 December this small coastal storm slowly moved up the east coast being located off Cape Hatteras, NC on the morning of 29 December. Rapidly picking up speed the storm was located off the Maine coast early the next day. The maximum H_{mo} , at gage 625, was 2.45 m ($T_p = 9.84$ sec) at 0734 EST. Onshore winds reached 11 m/s at 1900 on 28 December. Atmospheric pressure remained steady around 1022 mb. There was 9 mm of precipitation.

Distribution List

Government Agencies:

OCE	U.S. Geological Survey
BERH	U.S. National Park Service
NAO	U.S. Naval Academy
NASA/Wallops Flight Center	U.S. Naval Civil Eng. Lab
NOAA (NOS, NWS)	U.S. Naval Fac. Eng. Com.
SAD	U.S. Naval Oceanographic Off.
SAW	U.S. Naval Research Lab

Colleges/Universities:

California Inst. of Tech.	Stockton State College
East Carolina University	University of Akron
Florida Inst. of Tech.	University of Delaware
Harvard University	University of Florida
Naval Post Graduate School	University of Maryland
NC State University	University of Miami
Old Dominion University	University of North Carolina
Oregon State University	University of N. Colorado
Prince George's College	University of Rhode Island
Rutgers University	University of Virginia
Scripps Inst. of Oceanography	Va. Inst. of Marine Science
Southern Illinois University	

Others:

City of Va. Beach, VA	MEC Systems Corporation
Coastal Barge Corporation	Moffatt & Nichol, Eng.
Coastal and Est. Res., Inc.	Offshore Coastal Technologies
Coastal Science & Eng., Inc.	Mr. Rowland
Dr. Galvin	Mr. Savage
GEOMET Tech., Inc.	Sea Port Supply Corp.
Greenhorne & O'Mara, Inc.	Shell Development
Dr. Hylton	Sherwood Industries
Mary Marr, Inc.	Mr. & Mrs. Valpey
Mr. Mason	WCTI-TV
Masonite Corporation	SEASUN Power Systems

Foreign:

W. F. Baird & Asso. Coastal Engineers, Ltd (Canada)
Queen's University, Ontario (Canada)
Ministry of Construction, Coastal Division (Japan)
Norwegian Hydrodynamic Laboratories (Norway)
University of New South Wales (Australia)
University of Sydney (Australia)